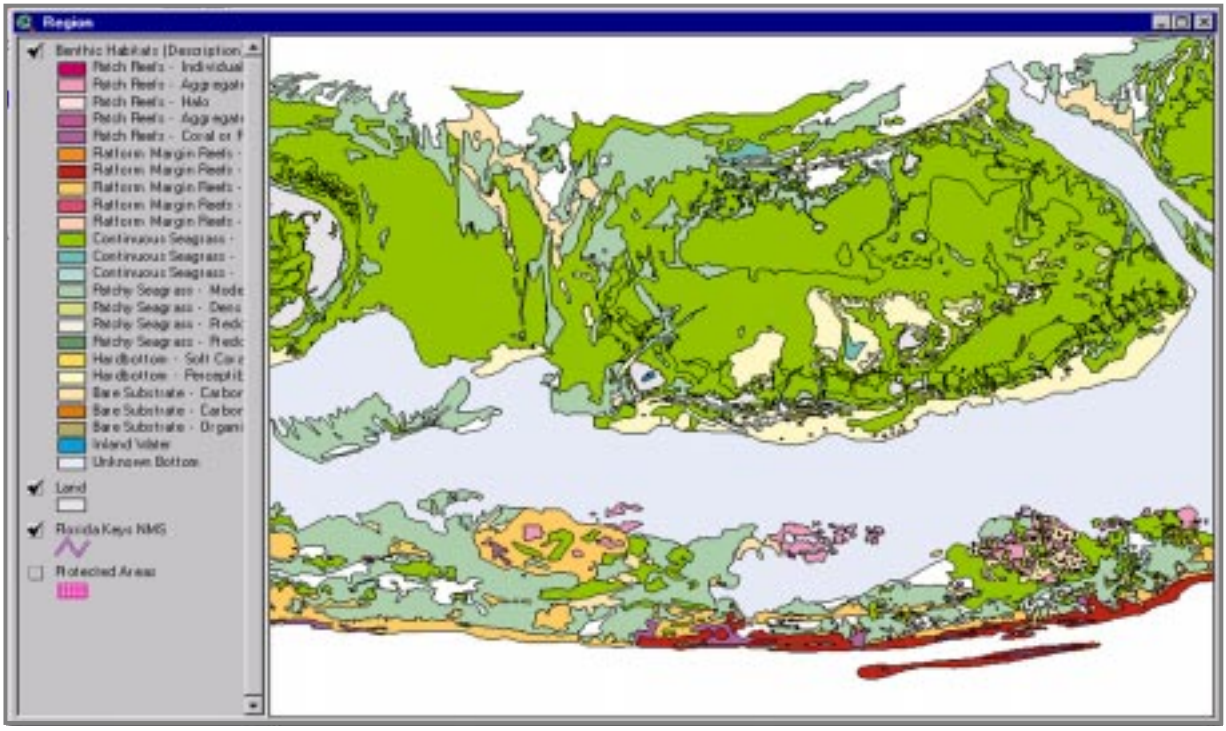
U.S. Coral Reef Task Force

Mapping and Information Synthesis Work Group:

Status Report

August 2000



Work Group Charge
Develop and implement a plan to produce comprehensive digital coral-reef ecosystem maps for all U.S. State, Territories, and Commonwealths within five to seven years.

Members/Participants
A list of individuals and agencies is found in the detailed Coral Reef Mapping Implementation Plan of 1999 (see http://coralreef.gov).

Applicable sections of the National Action Plan
Section III Taking Action
A. Understand Coral Reef Ecosystems 1. Map All U.S. Coral Reefs
Appendix C - Table A1 – Action Items 1-8

Accomplishments (Winter 1999 – Summer 2000)
- **Published** – A strategy to Map State, Commonwealth, Territory, and Freely Associated State Coral Reef Ecosystems in the U.S. (see http://coralreef.gov).
- **Published** – Coral Reef Mapping Implementation Plan: Mapping and Information Synthesis Working Group of the U.S. Coral Reef Task Force (see http://coralreef.gov).

Status of Action Items
Action Item 1. Puerto Rico and USVI High Resolution Digital Benthic Habitat Maps (see http://biogeo.nos.noaa.gov/benthicmap/caribbean)

- Draft digital habitat map completed for the southwest portion of Puerto Rico (4/2000)
- Draft digital habitat maps completed for St. John and St. Thomas (7/2000).
- Peer review and revision of St. John and St. Thomas (Fall 2000).
- Peer review and revision of digital habitat map for St. Croix (Fall 2000)
- Southern and Eastern shores of Puerto Rico draft digital habitat maps (Fall 2000).
- Western and Northern shores of Puerto Rico draft digital habitat maps (Winter 2001).
- Peer review and revision of all Puerto Rico digital habitat maps (Spring 2001).
- Publish digital maps via CD-ROM and Internet (Summer 2001).

Co-leads: NOAA, USGS, NPS, Puerto Rico, USVI

Action Item 2. Florida Keys – Supplemental Data Collection for Dry Tortugas Region

- Collected ship-based sidescan and multibeam data for selected areas in the Dry Tortugas that are proposed to be included in the joint NOAA, NPS, and Florida Ecological Reserve (June 2000)
- Processing of sidescan and multibeam data to digital habitat map products – Winter 2001.

- Conduct mapping and geological research on coral reefs in the Florida Keys (FY 2000).

Co-leads: NOAA, USGS, NPS, State of Florida.

Action Item 3. Hawaii High, Moderate, and Low Resolution Digital Benthic Habitat Maps (see http://biogeo.nos.noaa.gov/benthicmap/hawaii)

Low Altitude Aircraft Data Collection

- NOAA conducted data collection for the main 8 Hawaiian Islands that resulted in obtaining 1,654 aerial photographs for 67 flights lines (Spring 2000).
- Imagery reviewed and screened for quality with respect to feature detection of bottom habitats (Spring 2000).
- Completed draft classification scheme for aerial photography and hyperspectral imagery (Summer 2000).
- The next step in the process is to have the suitable imagery processed to high-resolution digital photographs (scans) to enable geo-referenced photo-mosaics to be developed and subsequent visual and/or automated classification of the imagery (Fall 2000).
- Implemented contracts with private sector and University of Hawaii for post processing of data to classified digital habitat maps (Winter 2001).
- Implemented pilot studies to determine applicability of classification scheme to Hawaii habitats and initiate classification of aerial photography and hyperspectral imagery (Winter 2001).
- A digital hyperspectral sensor (AURORA) was used to obtain spectral signatures on selected coral reef environments. The objective of the hyperspectral studies is to develop standard protocols that can be implemented to operationally map benthic habitats using this technology (Summer 2000).
- Of the 94 flight lines covering the main eight Hawaiian Islands, 35 were flown with the AURORA. The principle areas of coverage focused on the western coast of Hawaii, the southern shore of Maui, and the northeastern portion of Oahu (Summer 2000).
- A second effort to further advance the automation of coral reef mapping was a hyperspectral experiment conducted in Kaneohe Bay, Oahu. The objective was to determine the minimum in-situ data requirements to advance the application of interpretative algorithms to discern various levels of reef classification (Summer 2000).

Co-Leads: NOAA, USFWS, NPS, State of Hawaii, University of Hawaii, Contractors

High Altitude Aircraft Data Collection

- AVIRIS Hyperspectral data collection was conducted with a NASA aircraft over the Hawaiian islands (April 2000) (see http://seawifs.gsfc.nasa.gov/SEAWIFS/HTML/avris_flight_lines.html)
- Preliminary data processing completed at NASA's jet propulsion laboratory and tapes are being sent to NASA/Goddard space flight center for further processing and distribution (August 2000).
- A website displaying full resolution true color images of all the data acquired during the AVIRIS mission will be posted (August 2000).

Co-Leads: NASA, NOAA.

Satellite Data Collection

- Satellite imagery studies are focusing on the application of satellite multi-spectral data to coral reef mapping and monitoring. The evaluation efforts have included data collected at three levels: high resolution, local imagery from the IKONOS; medium

resolution, regional imagery from Landsat; and low resolution global imagery from SeaWiFS (FY 2000).
- Currently, IKONOS imagery has been purchased jointly by FWS and NOAA for Howland, Baker, and Jarvis islands, and acquisition orders have been placed for several areas in Hawaii (sections of Oahu, Maui, and Hawaii). Acquisition orders will be in place for 10 high priority areas within the Northwest Hawaiian islands (Fall 2000).
- Imagery is being processed by NOAA for detection and characterization of under-water features, extraction of bathymetry, detection of amount of live bottom, and for future determination of benthic change (FY 2000).
- The Landsat-7 satellite became operational in July 1999, and routine acquisition over coral reef islands (3-12 times a year) is a part of its mission. NOAA will have Landsat-7 scenes for all of the main eight Hawaiian islands (jointly obtained with Pacific Disaster Center), the NW Hawaiian islands, Guam, CNMI, portions of American Samoa, Palau, Palmyra Atoll, and Wake island (August 2000).
- NOAA will have Landsat-5 images from 1989-1993 for the main eight Hawaiian islands and for some of the NW Hawaiian islands. All will be processed in 2001 for maximum extraction of underwater features, particularly for the amount and change in amount of live bottom, results will be distributed through Web and CD resources. In 2001, acquisition will continue with repeat coverage of these areas and additional acquisition from other US-affiliated areas (Marshall Islands, Federated States of Micronesia, etc.)
- SeaWiFS provides a global perspective on the location of shallow water that may indicate potential coral reef habitat, with pixel resolution of 1-km and approximately one week repeat times. NOAA has developed algorithms for processing SeaWiFS to identify shallow water and live bottom and has provided this to the NASA SeaWiFS program for processing. NASA has established a web site for distribution of publicly accessible imagery, that has been processed, based on the SeaWiFS data (FY 2000).
- Co-leads: NOAA, NASA, USFWS

<u>Complementary USGS Mapping Related Studies</u>
- Obtained high-resolution (1:10,000 and 1:5,000) aerial photography for the reefs off south Moloka'i and southeast O'ahu.
- Mapped the entire reef tract of south Moloka'i and selected areas of east O'ahu and west Maui with SHOALS lidar at 4 meter spacing.
- Established, in cooperation with Hawai'i Institute of Marine Biology three CRAMP sites at 3 and 10 m on the south Moloka'i reef tract, and two photoquadrat sites at 1 m on the inner reef flat.
-Deployed instrumented tripod in Jan 2000 to continuously record waves, currents, and turbidity on the Moloka'i reef flat.
- Deployed sediment traps in Winter 2000 at the three CRAMP locations on south Moloka'i.
- Initiated a contract to collect high-resolution hyperspectral imagery over the south Moloka'i reef flat.
- Estimated percent coral coverage and major species at 10 m depth contour along the entire south Moloka'i reef tract at 1 mile intervals.
- Continuation of mapping sediment thickness, algae distribution, and coral presence on the extensive reef flat of south Moloka'i.

Lead USGS

Action Items 4-6 - High resolution digital benthic habitat mapping of American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands.

- No low or high altitude aircraft data collection initiated in FY 2000.
For satellite data collection see above section.

Action Item 7 –Satellite derived digital habitat maps of Howland, Baker and Jarvia Islands, Wake, Johnston, and Palmyra Atolls, and Kingman Reef.
See above Satellite Section.

Action Item 8 – Map and states, commonwealths, territories, and freely associated states using low to moderate resolution satellites.
See above Satellite Section.

Top 3 Barriers and Recommendations to Implementation of Mapping Plan

1) Must maintain current level of funding (approximately $2 million per year; includes new FY00 coral money to agencies and agencies re-direct of base funds) to continue successful implementation of the US CRTF Coral Reef Mapping Plan.

2) Must continue to improve Federal agency coordination efforts to maximize complementary synoptic coral reef mapping data collection efforts.

3) Must support research to enable development of more time efficient and accurate remote sensing methodologies to enable completion of mapping efforts within the next 6 years. Very limited funding has been allocated to research as most funds have been used to map using standard (e.g., aerial photography) methodologies.

Recommendations and Goals

Actions for implementation over the next 6 months include:

1) Process and develop draft digital benthic habitat map products from data collection efforts in FY 00.

2) Formalize within NOAA a dedicated coral reef mapping team across the National Ocean Service.

3) Hold a suite of meetings between NOAA, USGS, and NASA to better integrate Federal agency synoptic coral reef mapping efforts and to integrate and share resources, particularly for Landsat-7 based capabilities.

4) Revise the Mapping and Information Synthesis Work Group's Implementation Plan based on changes in technology and user requirements.

Summary

Overall the joint efforts of the Federal agencies, states, commonwealths, territories, and freely associated state partners have implemented a very successful effort to map US coral reef ecosystems. This has required dedication and commitments from all partners to integrate agency objectives, funding, technology and user requirements.

Over the next 6 months to continue successful implementation of the Mapping and Information Synthesis Work Group's Plan, will require continued funding to conduct the mapping studies. The Implementation Plan provides clear direction on the sequencing of digital habitat mapping efforts across all states and islands and only the Caribbean and portions of the Hawaiian Islands have been initiated to develop high-resolution digital maps. Thus, all other high-resolution priority areas need to be implemented over the next several years. In addition, the Mapping and Information Synthesis Work Group should convene a workshop to evaluate the results of the first year of mapping studies and to revise and update the Mapping Implementation Plan. Due to rapid advances in digital remote sensing technologies including hyperspectral scanners and increased resolution of satellite data, the Work Group should assess planned products for future years. For example, the Work Group should evaluate the tradeoffs between obtaining relatively high resolution satellite derived map products that have a limited number of habitat classifications (ca. 4 levels) in a short time period, compared to about 30 levels of habitat classification obtainable from low altitude aircraft remote sensing tools that are integrated with human interpretation of habitats and reef zones. Continued advances in remote sensing technology from aircraft, satellites, and ships in conjunction with improved integration of Work Group resources, will enable the goal of mapping all U.S. coral reefs to be obtained. The completion of the digital habitat "base" maps will provide the stage to conduct assessment, monitoring, and change analyses of U.S coral reef ecosystems. Ultimately, the benthic habitat mapping efforts will move from "snapshot" maps to routine monitoring of the distribution and health of coral reefs and defining and monitoring species habitat utilization patterns using a suite of in-situ, airborne, and space remote sensing platforms.

For More Information Contact:
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